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# SCIENCE

A WEEKLY JOURNAL DEVOTED TO THE ADVANCEMENT OF SCIENCE, PUBLISHING THE  
OFFICIAL NOTICES AND PROCEEDINGS OF THE AMERICAN ASSOCIATION  
FOR THE ADVANCEMENT OF SCIENCE

FRIDAY, FEBRUARY 22, 1907

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## THE BOTANICAL SOCIETY OF AMERICA

A UNION OF THE BOTANICAL SOCIETY OF AMERICA, THE SOCIETY FOR PLANT MORPHOLOGY AND PHYSIOLOGY, AND THE AMERICAN MYCOLOGICAL SOCIETY

THE first meeting of the united societies (the thirteenth annual meeting of the Botanical Society of America) was opened at Columbia University, New York City, December 27, 1906, under the presidency of Professor F. S. Earle. About sixty members were in attendance at the meeting, which was a most interesting one. The success of the meeting was in no small degree due to the thoughtful hospitality of the officers of the New York Botanical Garden, the Botanical Department of Columbia University and the Torrey Botanical Club.

The officers elected were:

*President*—Professor G. F. Atkinson, Cornell University.

*Vice-President*—Director N. L. Britton, New York Botanical Garden.

*Treasurer*—Dr. Arthur Hallock, New York Botanical Garden.

*Secretary*—Professor D. S. Johnson, Johns Hopkins University.

*Member of Council*—Professor H. M. Richards, Columbia University.

Seventeen associate members were elected and the total membership was increased to 135.

The society voted to hold its next annual meeting in conjunction with the American Association for the Advancement of Science.

Sessions for the reading of papers were

held at Columbia University on December 27 and 31, and at the museum of the New York Botanical Garden on the morning of December 29. At the latter meeting the presidential address—'The Organization of Certain Cœnobic Plants'—was delivered by Past President R. A. Harper. After the meeting a luncheon was served in the laboratories of the garden to the members of the society and Section G of the American Association for the Advancement of Science.

Abstracts of the technical papers read follow:

*Figures Produced by Protoplasmic Streaming in Fungi and Slime Moulds:* Professor R. A. HARPER, University of Wisconsin.

*The Origin of Air-Chambers in Liverworts:* Professor C. R. BARNES and Dr. W. J. G. LAND, University of Chicago.

Intercellular spaces are formed in higher plants by the splitting of cell walls and the separation of the cells by their unequal growth and turgor. The air-chambers of liverworts, especially of Marchantiales, are so peculiar in form that some peculiar mode of origin was looked for. Hofmeister ascribed their formation in *Marchantia* (1862) to the detachment of the epidermis and its lifting by the plates of cells which form the side walls. This view made the air-chamber only a special form of intercellular space. But Leitgeb controverted this interpretation (1880), and his view has been universally accepted for a quarter of a century. He ascribes the origin to a slower growth of the cells at the point where four to six lateral walls meet, and the consequent formation of a pit, which becomes overgrown by adjacent cells as it deepens. He emphasizes the statement that the lowest point of the pit is the original surface, and homologizes the air-chambers strictly with the pits, nearly

closed at mouth, in which many sex organs are sunk.

The authors show that Hofmeister probably did not see the real origin of the air-chambers, but only later stages in their development; that Leitgeb's observations, correct as far as his descriptions and figures show, were misinterpreted by him, and do not account for the course of development described; and further, his few observations of the real origin were actually distorted (according to his own confession) to fit his theory of the homology of the air-chambers with sex-organ pit.

Evidence can now be adduced, by means of the superior technique available, which shows beyond doubt that the air chamber appears first as an internal intercellular space, usually within two segments from the apical cell. This space increases in size, breaks out to the surface (rarely being met by inward splitting from the surface), and sometimes deepens by further splitting inward from the original point of origin. The remainder of the development is due to growth in all dimensions, but chiefly parallel to the surface. Thus the floor of the air-chamber, instead of arising from the original surface and being roofed over by adjacent cells, as is universally taught, is an internal surface, formed, as in other plants, by splitting due to unequal turgor and growth. Instead of being homologous with the sex-organ pits the air-chambers are strictly homologous with intercellular spaces generally.

*Fertilization and Embryogeny in Ephedra Trifurca:* Dr. W. J. G. LAND, University of Chicago.

In *Ephedra trifurca* Torr. the pollen chamber extends to the female gametophyte, and the necks of the archegonia are freely exposed. The pollen grains rest in the bottom of the pollen chamber in contact with the female gametophyte.

Cultures of the male gametophyte in saccharose solutions gave the following results: The exine is ruptured and its contents completely freed. The body cell gives rise to two elliptical male cells equal in size and optical appearance. Later the pollen tube appears and continues to elongate for about twenty-four hours. Fertilization is possible within ten hours after pollination. Four days having elapsed between the collecting of material at Mesilla, N. M., and its fixation at the University of Chicago, it was not possible to observe stages in the progress of the pollen tube to the egg.

The fertilized egg gives rise to eight free nuclei more or less unequal in size. The number of cells which reach the suspensor stage varies from two to five. Immediately after the egg is fertilized the walls of the jacket cells disappear and their contents are mixed with the cytoplasm of the egg.

The chromatin of the second male cell and also that of the jacket cells seems to be responsible for a mass of minute ephemeral cells. Possibly this mass of small cells may be looked upon as at least suggesting how the endosperm of angiosperms may have originated.

The functioning embryonal cells become spherical. Two free nuclei are formed in each embryonal cell and soon afterward the suspensor appears. After the suspensor reaches a considerable length one of the free nuclei passes into it and downward to the tip. Immediately above the latter nucleus a ring of cleavage appears in the cytoplasm, beginning at the suspensor wall and gradually continuing inward until the cytoplasm of the embryo is separated from that of the suspensor. A wall is then laid down and the separation is complete. The suspensor nucleus passes into the suspensor and takes a position near the embryo, where it soon disintegrates.

The walls of the embryo are laid down in the usual manner on the cell plate.

Under favorable conditions the development of the embryo is continuous and the young plant breaks out of the seed before the strobilus is shed. From the time the strobili can be recognized until the appearance of the young plant about six months elapses, being the shortest time yet reported for any gymnosperm.

*Dioon and Ceratozamia*: Dr. CHAS. J. CHAMBERLAIN, University of Chicago.

An account was given of a second trip made to Mexico for the study of *Dioon* and *Ceratozamia*, by the aid of a grant from the Botanical Society of America.

Fruiting specimens of *Dioon spinulosum* were not found during the trip, but material has been secured. There are frequently more than two ovules on a sporophyll, sometimes as many as five; the seeds are larger than those of any known cycad except *Cycas* itself. The ovulate cones are reported to be lateral.

*Ceratozamia* was found in considerable abundance. The motile sperms were studied in the living condition and material has been secured for a study of most phases in the life history. The seeds are small and are shed soon after fertilization, so that there is a continuous development, without any resting period, from fertilization up to the leafy plant.

A series of photographs were obtained, of which lantern slides were shown.

*The Genus Pleurococcus Culturally Considered*: Dr. G. T. MOORE, Bureau of Plant Industry.

*The Early Growth of Monostroma and Enteromorpha*: Dr. TRACY E. HAZEN, Barnard College.

Our knowledge of early stages of growth in the family Ulvaceae is comparatively meager. In the genus *Monostroma*, the

only complete account is that of Reinke on *M. bullosum*, a fresh-water species showing the nearest approach to *Tetraspora*, and not infrequently included in the latter genus. More extended investigation of the marine species is desirable.

In a *Monostroma* which is rather abundant on rocks and woodwork in harbors about New York (probably a small form of *M. crepidinum* Farlow) a fairly complete series of young plants has been obtained. The earliest stage is not a hollow sphere as described by Reinke for *M. bullosum*, but a short, erect filament somewhat resembling that of *Ulothrix*. Soon, by longitudinal divisions in its upper cells, this filament becomes club-shaped, and by further divisions, followed by separation of the cells, balloon-shaped. The lower cells divide little, but elongate to form the characteristic rhizoidal cells found in most Ulvaceæ. The balloon-shaped portion splits open at the top by irregular rents, to form the lobed, expanded thallus characteristic of the mature plants.

In two species of *Enteromorpha* found with the *Monostroma*, I have discovered a very similar early growth; beginning with the formation of a shorter filament, the thallus takes on a long cylindrical, club-shaped form, which becomes tubular directly, and not after the formation and subsequent splitting of a flat, two-layered sheet, as usually described for this genus.

The early growth of *Ulva* is also said to be filamentous. This similarity of young stages shown by these three genera appears to indicate a rather close relationship to the Ulotrichaceæ, so that the separation by recent writers of the Ulvaceæ to a distinct order may not be sufficiently warranted.

*Spore Formation in Derbesia:* Dr. B. M. DAVIS, Cambridge, Mass.

*Derbesia*, whose general morphology and

cytology is that of the Siphonales, is unlike the other members of this group in having very large zoospores, very unlike the small biciliate zoospores and motile gametes characteristic of this group of algæ, since each is provided with a large circle of cilia. The zoospores are developed in relatively small numbers (50–200), in sporangia which contain many thousands of nuclei when first formed upon the parent filaments.

A process of nuclear differentiation sets in shortly after the sporangia are developed. Some of the nuclei increase to four to six times their original size and finally become the nuclei of the zoospores. All others degenerate, decreasing in size, losing their chromatin content and finally breaking down in the cytoplasm. The large surviving nuclei are rather uniformly distributed throughout the cytoplasm, but are not associated with any cytoplasmic centers such as coenocentra.

The spores are formed by cleavage furrows which enter the protoplasm from the periphery and by branching in different planes cut out the protoplasm into approximately equal masses around the large nuclei. The nuclei at this stage lie in the centers of the spore origins and from them many delicate fibrils radiate into the cytoplasm among the plastids. These radiating cytoplasmic fibrils have small granules at their bases lying against the nuclear membrane.

The nucleus of each spore origin comes to lie near the periphery, the radiating fibrils on that side (about one third of the total number) becoming connected with the plasma membrane of the spore. The fibrils also take a funnel-shaped arrangement from the nucleus outward. The granules at the bases of these fibrils pass along them to the periphery and finally lie in a circle about twice the size of the nucleus, just beneath the plasma membrane.

The granules then fuse together to form a firm, deeply staining, homogeneous ring which is the blepharoplast, and lies very close to the plasma membrane but is not a part of it. The fibrils which connect the blepharoplast with the nucleus disappear and the nucleus somewhat later passes back to the center of the spore. The blepharoplast now splits into two rings, one directly below the other. Cilia grow out from the lower ring forming a circle around the zoospore, which is about one half the diameter of the latter.

*Sexuality in the Mucors:* Dr. A. F. BLAKESLEE, Harvard University.

The *Mucors* are divided into two groups termed respectively homothallic and heterothallic. In the homothallic group, zygospores are developed from the same thallus and can be obtained from the sowing of a single spore. In the heterothallic group, which comprises a large majority of the species, zygospores are developed from branches which necessarily belong to thalli diverse in character and can never be obtained from the sowing of a single spore. Every heterothallic species is therefore an aggregate of two distinct sexual strains through the interaction of which zygospore production is brought about.

In the heterothallic species *Mucor Mucedo*, the segregation of sex is completed at or before the germination of the zygospore and all the spores in a given germ sporangium are of the same strain, either male or female.

In the germination of the zygospores of the heterothallic species *Phycomyces*, a segregation of sex takes place at the formation of spores in the germ sporangium which contains both male and female spores. The liverwort *Marchantia polymorpha* has been found to correspond to this latter type of zygote germination and

male and female spores are contained in a single capsule.

Cultures were exhibited showing dark lines of zygospores between male and female strains of the same species and white lines of imperfect hybrids between male and female strains of different species. Microscopic preparations of zygospores of various species were also exhibited.

*The Teaching of the Subject of Respiration:* Professor CHARLES H. SHAW, Ursinus College.

The word respiration is used in several different senses. A confusion of ideas also exists. Except in connection with highly differentiated animals, the term respiration must signify either a gaseous interchange, or a metabolic process of energy release. The former definition lends itself to clear statement, is readily developed from experiments, and refers to a process which is really a non vital one. The latter, though not so easy to teach, refers to the essential process. For several reasons it is thought that the latter will stand. At all events the process of energy release must occupy the central place in teaching.

It is sometimes said that in respiration  $\text{CO}_2/\text{O}_2 = 1$ , and also that all protoplasm must obtain oxygen somehow all the time. Such formal ideas will not square either with the published facts upon the subject nor with class-room experiments.

The subject is worthy of a more adequate treatment in general courses. Eudiometers over mercury with the seeds held up by glass wool are one favorable form of apparatus for demonstrating.

*Relative Transpiration in Cacti:* Dr. BURTON EDWARD LIVINGSTON, Desert Botanical Laboratory.

After a preliminary discussion of the meaning of relative transpiration, *i. e.*, the ratio of the increment of water-loss from the plant for any time interval to the cor-

responding increment of loss from an evaporimeter for the same interval, the paper proceeds to present a new fact in regard to the regulation of transpiration. While ordinary leafy plants in some way retard water-loss during the hours of darkness and remove the retarding influence during those of light, the cacti, at least as far as the study has gone, act in a manner exactly opposite, applying the retarding influence during the daylight hours and removing it during those of darkness. Thus, for a given transpiring surface, leafy plants lose water in the daytime more nearly at the rate of the same area of free water surface than they do at night, and cacti more nearly approach the evaporation rate from a water surface during the night than in the daytime. Data as to the nature of the mechanism by which either group of plants accomplish their regulation of water-loss is as yet entirely lacking, since Lloyd, in a paper about to be published, has thrown great doubt on the usually accepted idea that this regulation is mainly accomplished through stomatal movements.

*The Water-Storing Tubers of Nephrolepis cordifolia*: Professor J. W. HARSHBERGER, University of Pennsylvania.

*Nephrolepis cordifolia* is a fern occasionally met in cultivation. When grown in the open it forms tubers the size of a walnut. These are developed at the end of lateral underground branches covered with flat, scale-like ramentæ which extend also to the surface of the tuber. The tubers do not store starch and other reserve foods, as an external examination of the tubers might lead one to expect, but the large, rounded, parenchyma cells are turgescient with a clear watery fluid, evidently stored against the time of drought, as the fern is usually epiphytic in habit.

When these tubers are dried, they dry until they almost entirely shrivel up.

*A New Native Host for Pearblight*: M. B. WAITE, Bureau of Plant Industry.

The pearblight bacillus, *B. amylovorus*, is undoubtedly a native parasite on the American indigenous species of Pomaceæ; it occurs nowhere else in the world and is quite commonly found on the wild crab-apples and hawthorns of the eastern United States.

When pears and apples and other pomaceous fruits were introduced into this country it promptly attacked them. It is quite easy to find new hosts on cultivated species of the Pomaceæ, as almost everything belonging to this family when grown within the territory affected is likely to be attacked. Some of these Pomaceæ look very unlike our ordinary pears and apples, but, nevertheless, may be subject to this disease, *e. g.*, the evergreen *Eriobotrya Japonica* is attacked by this disease very commonly in Florida and Georgia, and recently has been found affected in California. The arid plains and deserts and the Rocky Mountain region appear to have formed an insurmountable barrier, determining the western limits of the pearblight germ. Within the last few years, however, doubtless through human agencies, the pearblight bacillus has jumped, first to Colorado, Utah, Idaho, etc., and finally over the deserts and the Sierras into California. It is now attacking with unusual virulence the pear orchards of that state.

Few native Pomaceæ occur in California in the vicinity of the pear orchards. The beautiful, red-berried, California holly, *Heteromeles arbutifolia* Roem., is, however, quite common in the foot-hills of the Sierras, in the coast ranges, and comes down into the fruit regions. This shrub with its thick evergreen leaves looks very much unlike a pomaceous fruit, but was

carefully watched for a year as a host for pearblight. After having practically given this up, however, in March, 1906, I found a striking specimen, badly attacked, at Vacaville. It had been affected on the blossoms the summer before and several of the twigs contained the living bacilli, they having been carried over the winter. It has since been found at Colusa and several other points in California.

*The Causes of Dwarfing in Alpine Plants:*

Professor FREDERIC E. CLEMENTS, University of Nebraska.

Much attention has been given during the past eight years to the determination and measurement of the factors that determine alpine dwarfing in the Pike's Peak region of the Rocky Mountains. The work was begun with Bonnier's conclusions that the factors in dwarfing are stronger light, drier air and lower temperature, as working hypotheses. The behavior of many alpine polydemics which showed dwarf and normal forms at the same altitude, sometimes within a few feet of each other, indicated that light plays little or no part. Repeated and usually simultaneous measurements of light intensity were made in 1903, 1904, 1905 and 1906 at 1,900 m., 2,600 m. and 3,800 m. Midday readings at the three altitudes gave a value of 1 (comparative standard): in a few cases only, the intensity at 3,800 m. was 1.1 and 1.2. It is a well-known fact that the relative humidity increases with the altitude. As a rule, the relative humidity is 5-10 per cent. higher at 3,800 m. than at 2,600 m. and 15-20 per cent. higher than at 1,900 m. The variation is sometimes great, however, both simple and automatic readings giving now and then a lower humidity at the highest altitude. While humidity is not a factor in dwarfing, the reduced air pressure leads to increased transpiration, as demonstrated both by batteries of pot-

meters and by water surfaces. The thermograph records of several years all agree in showing a great and regular decrease in temperature as the altitude increases. The decrease is about  $1\frac{1}{3}^{\circ}$  for each 1,000 m., or an average difference of  $25^{\circ}$  F. between 1,900 m. and 3,800 m. The difference in the length of the season is correspondingly marked. The season is four and one half to five months at Manitou (1,900 m.) and two months on Mount Garfield (3,800 m.).

Of the factors stated by Bonnier, stronger light and drier air are not true of the region studied, and of course can play no part in dwarfing. Water content is the most important and universal factor, though its action is not at all restricted to alpine regions. Low temperature and shortness of season together stand next in importance, and even the third factor, reduced pressure, has a pronounced influence.

*The Origin of New Forms by Adaptation:*

Professor FREDERIC E. CLEMENTS, University of Nebraska.

For purposes of experimental evolution, a careful census has been kept at Minnehaha of species that are undergoing modification. This not only gave much insight into the methods to be employed in producing new forms experimentally, but, for the region studied at least, it gave decisive evidence upon the relative importance of the four methods of origin, namely, variation, adaptation, mutation and hybridation. During seven years, but one genus, *Machaeranthera*, showed sufficient variation to suggest that new forms might be arising from it in the manner assumed by Darwin. More than one hundred species have been recorded and studied in which new forms are arising by adaptation to new or changed habitats. Many of these ecads have been described



by systematic botanists as new species. With the exception of an occasional monstrous growth, the only mutants observed have been the albino forms of red- and blue-flowered species. Of these nearly thirty have been found. In the lack of experiment, no certain hybrids have been found. With the exception of the oak and the willow, however, no plants occur which furnish any suggestion of hybridation. In the region studied, accordingly, adaptation is by far the most frequent method of origin, mutation stands next, hybridation is rare if present, while origin by variation, *i. e.*, the indefinite variability of Darwin, is extremely uncertain.

*A Study of Disease Resistance in Watermelons:* W. A. ORTON, U. S. Department of Agriculture.

A paper presenting the results of work on watermelon wilt (*Neocosmospora vasinfecta* var. *nivea* Erw. Sm.). A disease widely distributed from Maryland to Florida and Alabama, and occurring also in Iowa, Oklahoma, California and Oregon. The fungus enters through the small roots and plugs the vascular system, causing the sudden wilting and death of the plant. It can pass its whole existence as a saprophyte, and does remain in soil and in farmyard manure piles for ten years or more, yet it is an active parasite of the watermelon, attacking plants growing under most favorable conditions. It is not a damping-off fungus, nor a wound parasite, but is highly specialized as to host plants, attacking only watermelons, while other forms morphologically indistinguishable occur in the same area as specialized parasites of cotton and cowpea.

It is believed that this specialization accounts for the successful production of resistant strains, and that similar results would be more difficult of attainment in

the case of diseases caused by fungi capable of attacking several hosts.

None of more than a hundred American and Russian varieties of melons tested proved resistant. The inedible citron or stock melon appeared to be immune, and was crossed with the watermelon in the hope of obtaining a resistant hybrid. A resistant strain of good quality developed in the third generation from this cross, and has become practically fixed after three years cultivation in isolated fields.

*The Problems of Vegetable Teratology:* Dr.

J. A. HARRIS, Missouri Botanical Garden.

*The Significance of Latency:* Dr. GEORGE

H. SHULL, Carnegie Institution.

Paper to be published in full in SCIENCE.

*The Organization of the Ecological Investigation of the Physiological Life Histories of Plants:* Professor W. F. GANONG, Smith College.

The paper calls attention to the changing conception of ecology, which is ceasing to be a search for utilities and is becoming an analysis of meanings. While in broad, general, or generic features, adaptation in the old causative or historical sense does exist, in details of structure and habit it is rare if not wanting, and most so-called adaptation is simply coincidence or toleration. In physiognomic ecology, therefore, the best working hypothesis is the assumption that the plant is an aggregate of physical needs which match or overlap the physical conditions presented by the environment, while the completeness of the overlapping determines the perfection of the 'adaptation.' The study of the physics of environments has made much greater progress than the study of the physical demands of plants, and the latter now offers the most important and attractive field for ecological investigation. The paper then

discusses the methods of such study, and a classification of the physiological processes for purposes of investigation, through the four critical periods of the plant's life history, germination, orientation of seedling, spread of adult, and fruiting or sporification.

*The Vegetation of the Blue Mountains of Jamaica:* Dr. FORREST SHREVE, Woman's College, Baltimore.

The Blue Mountains of Jamaica above 5,000 feet altitude in the neighborhood of Cinchona, the Tropical Station of the New York Botanical Garden, are covered by evergreen broad-leaved forest. Floristically the area is related to the surrounding tropical lowlands and to Eastern North America. In vegetative characteristics the forest likewise shows a blending of tropical and temperate features. The climate is one of much rainfall and high humidity. Alpine influences are but weakly operative at the highest altitudes. Local differences in the vegetation can be correlated with the topography and its determination of several of the physical factors. Bryophytes and Pteridophytes, as well as epiphytes, are abundant. There is a marked difference in humidity, light, wind and other factors between the forest floor and the forest canopy, with a corresponding contrast between the hygrophilous character of the terrestrial herbaceous vegetation and lower epiphytes, and the xerophilous character of the higher epiphytes and the foliage of the trees. The winter is relatively a season of rest in leafing and flowering, the spring and summer the seasons of greatest activity. Growth of leaves and shoots is extremely slow even in the most rapid growing forms. Transpiration is high under favorable conditions, but shows a high degree of sensitiveness to changes in temperature and humidity, and

under the climatic conditions commonly prevailing is very low.

*Cultures of Uredineæ in 1906:* Professor J. C. ARTHUR, Purdue University.

The experimental study in the life history of various species of plant-rusts, of which this paper is a report, has been in progress during the last eight years. It embraces rusts of economic importance, and others as well. The most notable result of the present year was with flax rust, which is very destructive in the flax fields of the northwest. It was found that this rust, unlike most of its near relatives, produces all its stages upon the flax plant, and that infection comes from the old straw and stubbles that have laid out of doors through the winter. The common rust on *Juncus tenuis* was found to be connected with the *Æcidium* on *Silphium*, and the *Uromyces* on *Scirpus fluviatilis*, with the *Æcidium* on *Cicuta maculata*. Considerable advance was made in separating the *Carex* rusts; and a number of *Leptopuccinia* were also grown. The work was aided by a grant from the society, and was in charge of Dr. E. W. Olive.

*Peridermium acicolum* the *Æcial* Stage of *Coleosporium Solidaginis*: Dr. G. P. CLINTON, Connecticut Agricultural Experiment Station.

*Peridermium acicolum* was found abundant on *Pinus rigida* at South Manchester, Conn., during the spring of 1906. It has been found in four different places in Connecticut—but has been reported only four or five times outside of the state, its distribution so far being confined to a small area extending from Massachusetts to New Jersey. After considering the synonymy in detail, the writer follows Arthur and Kern in calling the rust *Peridermium acicolum* (Und. & Earle). From observations made at South Manchester, verified

by an infection experiment, this fungus was shown to be the æcial stage of *Coleosporium Solidaginis* (Schw.) Thm., which is common throughout the United States on goldenrod and asters. This conclusion is based upon the following points: (1) No other suspicious rust followed the attack of the *Peridermium*. (2) The *Coleosporium* (both II. and III.) occurred abundantly on *Solidago rugosa* under trees having the *Peridermium* but not under trees free from it and slightly removed. Instances were found where infected pine leaves interlocked with plants of *Solidago* and in these cases the leaves of the *Solidago* were badly peppered with the uredinial sori of the *Coleosporium*. (3) The time sequence of the two rusts was just as it should be if they were related. (4) An indoor infection experiment with spores of the *Peridermium* on a plant of *Solidago rugosa* was successful in producing the *Coleosporium*.

*Culture Studies on the Polymorphism of Basidiomycetes:* Dr. GEO. R. LYMAN, Dartmouth College.

The life histories of about seventy-five species of Thelephoraceæ, Hydnaceæ and Polyporaceæ were studied in pure cultures with especial reference to the occurrence of secondary methods of reproduction. About 40 per cent. of the species studied showed polymorphism of some form.

Oidia were found in fully one half of the species of Polyporaceæ studied, but not in the other two families. Chlamydospores of the ordinary type were found upon the mycelia in all three families and in about one fifth of the species. Secondary methods of reproduction of a higher order were found in six species as follows:

1. *Michenera Artocreas* B. & C. was shown to be the imperfect form of *Corticium subgiganteum* Berk. The spores of *Michenera* are highly specialized chlamydo-

spores which form a definite fructification of their own with a well-defined hymenium.

2. *Corticium alutaceum* (Schrad.) Bres., has two methods of secondary reproduction: (a) conidia of a simple oidium-like nature produced on the young mycelium; and, (b) red-brown spore-balls or bulbils of the *Helicosporangium* type produced in great profusion on the mature mycelium.

3. *Peniophora candida*, n. sp., is the perfect form of the well-known *Ægerita candida* Pers., and commonly occurs with it.

4. *Corticium roseo-pallens* Burt, produces conidia in great abundance on the mycelium. The conidia closely resemble the basidiospores and are produced successively until groups of two to ten are formed on low elevations on the sides of the hyphæ.

5. *Corticium effusatum* C. & E., produces mycelial conidia of the *Ædocephalum* type in all cultures, thus recalling Brefeld's *Heterobasidion annosum*. The mycelium also produces abundant chlamydo-spores.

6. *Lentodium squamulosum* Morg., the only fleshy fungus cultivated, bears helicoid conidia upon long attenuated hairs arising from the young veil and from the margin of the developing pileus. The principal interest attaching to this species, however, lies in the structure and method of development of the basidiosporic fructification. The stipe and pileus are those of an agaric, but the hymenial region is occupied by a thick layer of irregular tubes and chambers whose external openings are more or less completely closed by a white flocculent veil. Diffusely spreading hyphæ arising from the trama form this veil, and by influencing the direction of growth of the hymenial plates, cause the porose-cellular character of the hymenial layer. The writer believes that *Lentodium* is not a monstrosity, as has frequently been held, but is an autonomous species whose sys-

tematic position is between the Agaricaceæ and the Polyporaceæ.

*Ascigerous Forms of Glæosporium and Colletotrichum*: C. L. SHEAR and ANNA K. WOOD, Bureau of Plant Industry.

Stoneman, Clinton, Spaulding, von Schrenk and Sheldon have already given the life histories of a number of forms. Klebahn has also reported ascigerous stages of two species which have been referred to *Glæosporium*, but which are evidently not congeneric with the organisms studied by the other authors mentioned, and by the present writers.

Forms from eight different hosts have been grown in pure cultures and both conidial and ascigerous perithecia produced. The forms studied occurred upon the following hosts: grape (*Vitis* sp.), apple (*Pyrus malum*), cranberry (*Vaccinium macrocarpum*), rubber plant (*Ficus elastica*), locust (*Gleditschia triacanthus*), *Ginkgo biloba*, cotton (*Gossypium* sp.) and bean (*Phaseolus vulgaris*).

The form on the apple has been grown several times before. In none of the other cases mentioned has the ascigerous form been heretofore produced, as far as known. The forms investigated can not be specifically segregated by morphological characters, and for the present are regarded as varieties of a single species. The ascigerous form has been found upon its host under natural conditions in only two cases, viz., on the apple and *Ficus elastica*. The presence of paraphyses has been reported by Sheldon. Organs sometimes occur which, if not aborted or mal-formed asci, may be called periphyes. The factors which determine the production of the ascigerous fructifications are still doubtful. Having once obtained a race or individual which produces asci, it can be successfully grown on various media and under various conditions. The mycelium, having entered

the tissues of its host, has the power of remaining dormant for an indefinite period.

*A New Chrysanthemum Disease—The Ray Blight*: Professor F. L. STEVENS, North Carolina College of Agriculture and Mechanic Arts.

Specimens of this disease were first received from Fayetteville, N. C. It was later found in Raleigh. Its most conspicuous appearance is as a blight of the ray flowers of the head. It also occurs in the stems. Examination showed a fungus constantly present in the diseased part. This was repeatedly isolated by plate culture; its culture characters were studied on various media; and its temperature and acid relation were determined. Inoculations were then made upon chrysanthemums under various conditions, producing typical cases of disease. The organism was recovered from these artificially inoculated blossoms and proved identical with that found in cases of natural infection. The fungus belongs to the genus *Ascochyta*, apparently a new species for which a technical description is provided.

*A Potato Leaf-blotch Fungus New to America*: Professor L. R. JONES, University of Vermont.

The fungus in question is *Cercospora concors*, first described by Dr. Robert Caspary in 1854, from collections made in the vicinity of Berlin. Since that date it has been observed with increasing frequency in Europe, proving most serious in the northern sections. The author has found it in Vermont at three well-separated stations and in three seasons, the first collection having been made in 1902. It has occurred in each case in old gardens and the indications are that it is a well-established parasite on the cultivated potato and probably widely distributed in the longer settled parts of the northeastern states and

Canada. Its attacks are confined to the leaves. It develops at the same season and under generally similar conditions to the well-known early and late blight fungi (*Alternaria solani* and *Phytophthora infestans*) and bears so close a resemblance in gross appearance to these that it has probably been commonly overlooked or confused with these diseases. Its cultural characters have been studied in detail. On artificial media it produces only a resting form of chlamydospore, similar to that produced in dead potato leaves. It is believed that the usual spraying methods will hold it in check. Certain varieties of potatoes show well marked resistance to this fungus. A detailed account of these studies will appear in the forthcoming (1906) report of the Vermont Experiment Station.

*A Bibliography of North American Lichenology:* Professor BRUCE FINK, Miami University.

The paper attempts to give all titles pertaining to North American lichenology, from the first certain statement regarding our lichens, about the beginning of the eighteenth century, to the present time, completing a preliminary announcement concerning the bibliography made in 'Two Centuries of North American Lichenology,' *Proc. Ia. Acad. Sci.*, 1-38, 1904. With each title appear explanatory notes as to contents.

*American Fossil Mosses, with Description of a New Species from Florissant, Colo.:* ELIZABETH G. BRITTON and Dr. ARTHUR HOLLICK, New York Botanical Garden.

During the summer of 1906 Professor Theo. D. A. Cockerell and his wife made extensive collections of fossil plants in the well-known Tertiary beds at Florissant, Colorado. From among the specimens collected a beautifully preserved fossil moss, in fruit, was kindly transmitted to us for

examination. It will shortly be described and published under the name *Glyphomitrium Cockerellæ*. The specimen is here for examination.

Thousands of specimens of fossil plants have been obtained from this locality by other collectors from time to time, but only three which have been regarded as mosses have been heretofore brought to light, and none of these is in fruit.

This class of plants is exceedingly rare in the fossil state and all of the hitherto described American species are sterile, the generic determinations having been based entirely upon leaf characteristics, so that such determinations were neither conclusive nor satisfactory and in some instances even their reference to the mosses is questionable. The specimen before us may therefore be said to be the first one from America in which a positive identification has been possible.

*Some Changes in Wood Fiber immersed in Water:* Dr. H. VON SCHRENK, Missouri Botanical Garden.

*Recent Identifications of Cretaceous Gymnosperms from Kreischerville, N. Y.:* Dr. ARTHUR HOLLICK, N. Y. Botanical Garden, and Professor EDWARD C. JEFFREY, Harvard University.

One of the best founded adverse criticisms in paleobotanical work is that determinations of generic and family relationships of fossil plants are necessarily based almost exclusively upon external characters. This has undoubtedly been the case in regard to the determination of fossil leaves, both of angiosperms and of gymnosperms, and it will continue to be inevitable as long as only the impressions of the leaves are available for study. If, however, certain of the leaves or leaf impressions are found associated or actually connected with twigs, or branches, or cones,

or other parts in which the plant tissue is sufficiently well preserved for sectioning and microscopic examination, the ordinal, or family, or even exact generic relationships may be accurately determined.

Such conditions of preservation have been found in the Cretaceous deposits at Kreischerville, on Staten Island, and a large amount of material from this locality has been collected and subjected to critical examination. Some of the preliminary results thus obtained form the basis of this communication.

The lantern slides show microscopic enlargements of cones of *Protodammara*, sections of the wood of *Brachyphyllum* and other gymnosperms, demonstrating their Araucarineous affinities, and sections of *Pityoreylon* with resin canals, indicating the probable sources of the amber which is abundant in the deposits.

*Some Vestigial Characters in the Cone of Pines:* Professor E. C. JEFFREY, Harvard University.

*Classification of the Genus Panicum:* A. S. HITCHCOCK, U. S. Dept. of Agriculture.

In the comprehensive works of Bentham and Hooker (Gen. Pl.) and Engler and Prantl (Pl. Fam.) the large genus *Panicum* was divided into a number of sections, such as *Digitaria*, *Trichachne*, *Thrasya*, *Echinochloa*, *Hymenachne*, *Ptychophyllum* and *Eupanicum*. Most of these sections may more conveniently be considered as genera, this division being based upon well-marked characters of both structure and habit. Retaining the name *Panicum* for most of what has been included in the section *Eupanicum*, this genus may again be divided into groups, of which the following are American: *Ramileta*, *Fasciculata*, *Prostrata*, *Agrostoidia*, *Laxa*, *Maxima*, *Brevifolia*, *Verrucosa*, *Capillaria*, *Prolifera*, *Dichotoma*, *Parvifolia*, *Virgata*, *Diffusa*,

*Divaricata* [Sect. *Lasiacis*]. These names should not be considered as sectional names. They are merely group names formed from a well-known specific name of each group. *Ptychophyllum* and *Lasiacis* should probably be assigned generic rank. The group *Dichotoma*, which includes about one hundred closely allied species of the southeastern United States, can again be divided into a number of subgroups, the classification being based upon habit, size and pubescence of skelatlils, ligner, pubescence of culms, sheaths and blades, and the manner of branching of the fall culms. These groups are: *Depauperata*, *Laxiflora*, *Angustifolia*, *Eudichotoma*, *Nitida*, *Lanuginosa*, *Unciphylla*, *Eusifolia*, *Sphaerocarpa*, *Corurnutata*, *Lancearia*, *Oligosanthia*, *Scoptaria*, *Latifolia*.

DUNCAN S. JOHNSON,  
Secretary

THE JOHNS HOPKINS UNIVERSITY

THE AMERICAN ASSOCIATION FOR THE  
ADVANCEMENT OF SCIENCE  
MEETING OF SECTION E—GEOLOGY AND  
GEOGRAPHY

ON account of the special meeting of the association at Ithaca in July, 1906, at which Section E had a full program of papers and excursions, no effort was made to get papers for the New York meeting of the association. Some fifteen papers, however, were spontaneously offered in addition to the vice-presidential address, and Section E held four sessions during the New York meeting.

At the session for organization held at Schermerhorn Hall, Columbia University, directly after the adjournment of the first general session of the association on December 27, Professor J. B. Woodworth, of Harvard University, was elected a member of the sectional committee for the term of five years, Professor N. M. Fenneman was elected a member of the general committee,